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ALFALFA IN ALBERTA

BY

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Alfalfa in Alberta

BY

JAMES R. FRYER

This bulletin has been prepared as a result of a recent general interest in alfalfa, which has arisen among farmers in the Province of Alberta, and in response to the many inquiries that have come to the University for information regarding varieties, culture, methods of handling, etc., in connection with the production of hay, pasture and seed crops of alfalfa. An effort has been made to discuss very briefly various aspects of alfalfa production in Alberta and to present concisely certain recommendations which it is hoped will be of some benefit to farmers who may feel the need of information or guidance concerning the growing of this important forage crop.

Acknowledgments.

The writer wishes gratefully to acknowledge his indebtedness to Professor James Murray for many important suggestions regarding alfalfa culture on dry and on irrigated land, and also to Mr. G. M. Stewart for valuable assistance, particularly in connection with the section on "Seed."

Importance of Alfalfa.

Alfalfa extensively grown.—Alfalfa has been claimed justly to be the best forage crop man has ever been privileged to use. It was grown 2,500 years ago in Persia, and has since been introduced into practically all agricultural parts of the world. In North America it has been grown for about 150 years, but not extensively until the last four or five decades. At present it is a crop of importance in every province of Canada and in every state of the United States. In some regions, particularly in arid and semi-arid areas, where irrigation farming is practised, it is very extensively grown. Canada had 910,156 acres in alfalfa in 1927, which was about ten times the acreage in 1911. Alberta had 40,925 acres in 1928, or about sixteen times the area under alfalfa in 1910.

Agricultural values.—Alfalfa may be used for hay, pasture or soiling purposes, and gives high yields of most nutritious

forage. In Alberta it has yielded an average of about 2.3 tons of cured hay per acre, as compared with an average of about 1.2 tons per acre for other tame grass and clover hays. The quality of well-cured alfalfa is superior to that of any other of our cultivated grasses or legumes. This is due to its richness in both protein and lime, and also because of its laxative effect on all classes of live stock. It is particularly valuable for dairy cows because of the abundance of protein and lime it is capable of supplying for milk production. As a feed for growing animals alfalfa is also much to be preferred to any of the grasses.

Although a stand of alfalfa is somewhat more expensive to establish than that of almost any other hay or pasture crop, alfalfa is a relatively cheap kind of forage to produce. This applies of course only where the crop can be satisfactorly grown and where good stands are allowed to remain down for four or five or more years. Experiments have demonstrated the production of alfalfa hay at a cost of about 40 per cent. of the value of the cured hay, while tame hays of other kinds under similar conditions were produced at a cost of from 60 to 100 per cent. of the value of the cured hay.

Soils low in nitrogen are benefited by growing alfalfa crops as is the case with other leguminous crops, but soils which are already high in nitrogen are not believed to be improved in this respect by growing alfalfa on them. In heavy soils the deep roots of alfalfa are beneficial in loosening the lower soil for aeration and the penetration of water. The alfalfa hay crop is also valuable as an aid in weed control. Certain weeds, as for example, Canada thistle, wild oats and many annual weeds the seeds of which are not able to lie dormant for many years in the soil, are unable to survive in alfalfa hay meadows. The periodic cutting of the crop prevents these weeds from seeding, and if the crop stands for several years the weed seeds of many annuals do not survive in the soil. Alfalfa does not, however, help to eradicate certain perennial grasses. Spring and after-harvest cultivation must be applied to keep these in check.

Varieties.

There are many varieties of alfalfa, which vary widely in such characters as winter-hardiness, habit of growth, fodder-producing capacity, seed-setting ability, flower color, etc. Relatively few varieties are suitable for Alberta conditions. The Grimm variety, however, can confidently be recommend-

ed. This variety is winter-hardy and high-yielding, and it has been successfully grown in many parts of the province, both in the south and in the north. Cossack, Ontario Variegated and Baltic are other varieties which are reputed to be hardy and high-yielding, but their reputations in Alberta are not based on long-period, widespread and elaborate expermentation, as is the case with the Grimm variety.

A good row of Grimm alfalfa in variety tests at the University of Alberta.

Securing a Good Stand.

Choice and preparation of soil.—Alfalfa is adapted to a wide range of soil types, but it does not thrive on poorly drained soil, nor on soil that does not contain a fair amount of lime. It will not survive long on water-logged land. Plants a year or more old will tolerate some alkali, though the seedlings are much less tolerant. Alfalfa is less tolerant of black and brown alkalis than of white alkalis. Fields which have pot-holes should be avoided; these depressions are likely to become filled with water as a result of chinooks or spring freshets. Covering with water or ice for several days usually proves fatal to alfalfa plants.

To secure a good stand of alfalfa it is desirable to use land which is free from serious weeds, particularly perennial grasses like couch grass, brome grass, Kentucky blue grass, wild barley, etc. Land that is badly infested with annual

weeds is also undesirable. Dirty land should be cleaned as well as possible before seeding to alfalfa. For Alberta conditions well-prepared summerfallow, or clean hoed-crop land, provide the best preparations. The land should be cultivated and harrowed in the spring to work up a good seed-bed. As many weed seedlings as possible should be destroyed by cultivation and a seed-bed which is firm below with an inch or an inch and a half of fairly fine soil on top should be aimed at. If necessary the packer should be used to bring about the firm condition of the soil. The firm seed-bed tends to hold moisture near the soil surface where it is needed for the germination of the alfalfa seed, which should not be planted more than about an inch or an inch and a half deep.

It is doubtful if it is advisable to use stubble land for alfalfa, particularly in the drier parts of the province except on irrigated land, as a seed-bed suitably firmed, moist and free from weeds is difficult to obtain. If a clean stubble soil in the more humid parts of the province has plenty of moisture in the spring it may be plowed early (preferably after burning off the stubble), and worked down immediately to the desired state of firmness below and fineness on top, thus preventing the drying-out of the soil. This practice, however, affords little opportunity to clean the land from weeds before seeding if weed seeds or the roots of perennial weeds are prevalent in the soil.

Seed.—It is important to use seed of good quality. Seed which has been officially graded No. 1 by the Dominion Seed Branch is recommended, or better still Alberta-grown Registered No. 1 Grimm alfalfa seed, which represents the highest quality of seed that can be obtained. If seed of lower grades must be used it is important to ascertain the impurities contained and the germinability of the seed.

In buying alfalfa seed it is important to find out, previously if at all possible, the particular kinds of weed seeds contained in the seed; No. 1 seed may contain as many as five noxious weed seeds per ounce. (Registered No. 1 alfalfa seed may contain only one noxious weed seed per ounce.) Evidently, No. 1 seed may be capable of introducing some serious kind of weed into a district previously free from it. Every lot of alfalfa seed legally offered for sale in Canada is covered by an official certificate which not only designates the grade, but also lists the kinds and proportions of weed seeds contained in the seed. The farmer should ask to see a copy of this certificate before purchasing. If the certificate is not available, the farmer may send a sample of the seed, either before or

after buying, to the Dominion Seed Branch, Calgary, Alberta, and an official certificate listing the weed seeds in the sample will be returned to him. (Three samples may be tested free of charge for any one person or firm in one year.) This certificate will inform him as to the kinds of weeds he may expect to grow in his alfalfa crop from the use of the seed in question.

Imported seed is to be used with great caution, and only that imported from the northern prairie states bordering on the prairie provinces of Canada. Alfalfa seed imported from these states is required by Canadian law to be colored navy blue to the extent of 1 per cent., and it must be accompanied by a state certificate to the effect that the seed is Grimm, Baltic or a kindred variegated variety of alfalfa.

Registered alfalfa seed is put on the market by members of the Canadian Seed Growers' Association,* the Grimm Alfalfa Seed Growers' Association, Brooks, Alberta, and the reliable seed houses in western Canada. Commercial (non-registered) grades of alfalfa seed may be obtained from many of the larger and local seed houses.

Inoculation.—When alfalfa seed is to be sown on land that has not grown alfalfa or sweet clover in recent years, it is recommended that either the soil or the seed should be inoculated with a certain kind of bacteria which grows on the alfalfa roots and is beneficial to the normal growth of the alfalfa plant.

Three methods of inoculation are recommended, namely:

(1) The application to the seed of a bacterial culture artificially prepared.

(2) The application to the seed of soil from an old alfalfa or sweet clover field by the glue method.

(3) The application of soil from an old alfalfa or sweet clover field to the field to be inoculated.

Preference is to be given these methods in the order in which they are here mentioned.

First method.—Freshly prepared cultures of the right kind of bacteria should be obtained, shortly before seeding. The School of Agriculture, Vermilion, Alberta, or the Division of Bacteriology of the Central Experimental Farm, Ottawa, will send cultures at a small charge to farmers upon application. Applicants should state the kind and amount of seed to be inoculated, and request directions for the use of the culture.

*To get into communication with members having registered alfalfa seed for sale, write to the Dominion Seed Branch, Calgary, Alberta.

Second method.—The seed is moistened with a 5 or 10 per cent. solution of glue (about ½ pound of furniture glue to one gallon of water). Soil from an old alfalfa or sweet clover field taken between depths of about two inches and about six inches is sifted on the moistened seed. About two to four quarts of soil per bushel of seed are needed. The seed and soil should be shovelled over a few times and sown within a day or two. Neither the soil nor the seed after inoculation should be exposed to the sunlight, and if seeding must be delayed a few days the inoculated seed should be spread out to dry in a shaded place to prevent the development of mould.

Third method.—Soil is secured from an old alfalfa or sweet clover field between the depths of two and about six inches. This is applied to the field to be seeded at the rate of three or four hundred pounds per acre, just previous to seeding. The field should be harrowed, disced or drilled at once in order to cover the bacteria which are destroyed by sunshine.

One objection to the second and third methods is the possibility of the transfer of disease organisms with the soil from one field to another.

Further information regarding inoculation of alfalfa and other legumes may be found in Circular No. 4, University of Alberta, "Legume Inoculation." This circular may be obtained by applying to the Department of Extension, University of Alberta, Edmonton.

Should a nurse crop be used?—In practically all parts of Alberta at present under agriculture, it is strongly recommended that alfalfa be sown without a nurse crop which is intended for grain or green feed. In many seasons in the drier parts of the province the use of a nurse crop results in entire failure and it always involves risk of a poor and unprofitable stand of alfalfa. If the sacrifice of a crop from the land while the stand of alfalfa is being established is felt to be too serious a matter financially, it is advisable to plant small units annually, employing only methods which give the greatest assurance of a successful stand, rather than to put in at one time a large area by methods which give relatively greater chances of a failure or of a poor stand. Only a full stand should be the aim. A good stand well cared for should give a big average return for five or six or more years, the cost of establishing the stand being spread over the period of production.

In localities where soil drifting is liable to be troublesome half a bushel of barley per acre may be planted with the alfalfa. The barley grows quickly and checks drifting. It

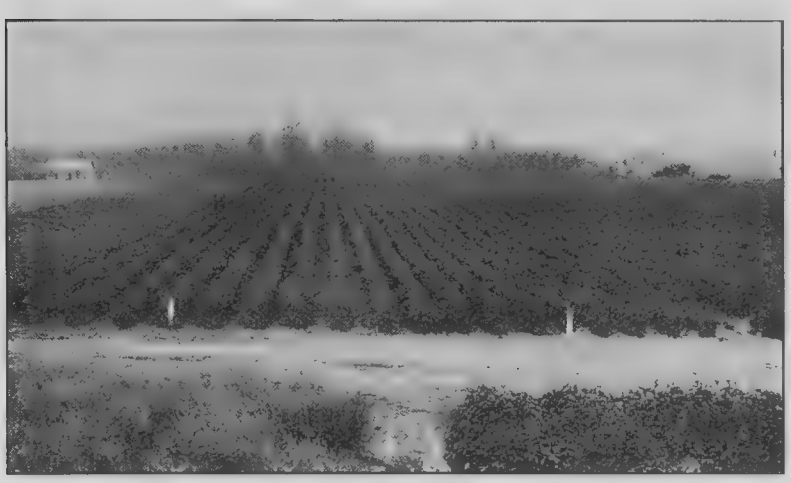
should be cut frequently, however, with the mower during the summer, the cut leaves being allowed to lie on the ground to reduce to some extent the drying out of the soil. The cutting should be high enough to avoid cutting off much of the alfalfa seedlings. The cutting also keeps in check weeds that grow up in the crop and tend to smother and rob of moisture the delicate alfalfa plants. The stubble and debris, moreover, help to hold snow for winter protection. Where alfalfa is seeded alone it will also likely be necessary to mow during the summer to keep down weed growth.

On irrigated land, where moisture conditions are under control, it is the general practice to seed alfalfa with a nurse crop. If this is done it is probably desirable to reduce somewhat the usual rate of seeding of the nurse crop. The alfalfa seedlings should be watched carefully, and at the first appearance of wilting water should be applied.

Methods of seeding.—The ordinary grain drill or the press drill may be used quite satisfactorily for seeding alfalfa if the seed is first mixed with about twice its bulk of cracked grain of wheat, barley or rye. The admixture of cracked grain makes possible a more even distribution of the alfalfa seed and enables one to regulate the drill to sow the proper amount of seed. The drill should be set to sow about an inch or an inch and a half deep. This method insures a uniform depth of seeding and the adequate covering of all the seed. This is in contrast to the broadcasting method of seeding where some of the seeds lie in the dry surface soil and do not germinate unless the weather conditions are very favorable. Seeding deeper than an inch and a half should be guarded against, as seedlings are usually unable to grow to the surface of the soil if the seed is seeded deeper than this. If the ordinary grain drill is used it is advisable to pack after seeding in order to firm the soil about the seed; this seems to facilitate moisture absorption by the seeds and hence their germination. If a press drill is used this is of course unnecessary.

On irrigated land where alfalfa is to be seeded with a nurse crop the grass-seeder attachment may be used. The alfalfa seed must not, however, be diverted into the grain tubes if it is likely to be seeded more than an inch and a half deep. Or, the alfalfa may be seeded broadcast after drilling the nurse crop and harrowed in. Packing after the harrowing is likely to be beneficial in that it firms the soil about the seeds.

In very dry areas alfalfa is frequently seeded in drills spaced 30, 36, 42 or even 48 inches apart. This practice is sometimes adopted for alfalfa seed production, where the widely-spaced condition appears to be more favorable for seed-setting than crowded stands. It also permits of inter-row cultivation which helps to keep down weeds. For seeding widely-spaced rows the ordinary grain drill or the press drill may be used as outlined above except that only certain tubes, depending on the desired spacing, are allowed to sow seed, the other tubes being stoppered to prevent the passage of seed. The turnip or beet drill may also be used for this method of seeding if suitably adjusted to sow the proper amount of seed.



Alfalfa growing in rows 30 inches apart at the University of Alberta.

Time of seeding.—The time for seeding alfalfa where a nurse crop is not used ranges in Alberta from May 15th to July 1st. The early spring season should be utilized for preparing the proper type of seed bed and for destroying as many weeds as possible by cultivation. With a seed bed prepared by June 1st it is a good practice to sow thereafter when the moisture conditions in the soil are favorable for germination. Where alfalfa is seeded with a nurse crop, as on irrigated land, seeding should be early in May so as to permit the nurse crop to be removed early and thus allow as much opportunity as possible for the alfalfa to acquire a good growth in order to prepare itself for the winter.

Rate of seeding.—If alfalfa seed is to be sown with an ordinary grain or press drill as described above, from 10 to 12 pounds of good seed are sufficient, but under irrigation where an abundance of water is available and a hay of fine quality is wanted, from 15 to 18 or 20 pounds are used. Where seed is sown in 36-inch rows 2 to 4 pounds are ample.

Care and Maintenance of a Good Alfalfa Stand.

The first season.—The alfalfa plant when well established with a good root system in favorable soil is quite drought-resistant and is very tenacious of life, but as a seedling it is feeble, shallow rooted and may easily be killed by unfavorable conditions. Consequently the first year of the alfalfa plant's life is the most critical. The seedlings cannot well endure drought or severe competition for moisture and light with weeds and other vigorous crop plants. This circumstance necessitates rather careful manipulation the first season, especially in dry regions. This is the reason for advising against the use of a nurse crop, for eradicating the weeds as far as possible before seeding and for the summer clipping to keep down the growth of competing plants.

The alfalfa crop should in no case be pastured the first season, as trampling may do serious injury to the young plants. Ordinarily the first season's growth should not be cut for hay, but on irrigated land in the southern parts of the province early seeding may give a light cutting of hay by the middle of August. Cutting for hay or clipping should not, however, be done after August 15th, as six or eight inches of growth are desirable before the crop goes into winter.

Alfalfa seeded without a nurse crop or with a light seeding of barley for protection against drifting may be clipped at intervals from the time of seeding until August 15th. The clipping should be done whenever any appreciable growth of barley or weeds has taken place. The cutter-bar of the mower should be set to cut above the alfalfa plants or to cut off as little of the alfalfa plants as is practicable. The cut material should be left in the swath where it will soon dry up and act to some extent as a protection against evaporation of moisture from the soil and the alfalfa seedlings beneath.

In case the alfalfa is seeded with a nurse crop which is to be used for grain or green feed purposes there is little to be done. The nurse crop should be harvested and removed

promptly, however, so as to give the alfalfa seedlings the best possible chance to grow before cold weather arrives.

Cultivation in subsequent seasons.—Good stands of alfalfa tend to depreciate year after year unless they are given proper treatment. There may be some loss through winter-killing, but this, however, is minimized by the use of the hardiest and best adapted varieties. Apart from this loss, certain weeds, chiefly certain perennial grasses, are sure to establish themselves in alfalfa. They spread by root stocks and hence the frequent cutting of the alfalfa for hay does not keep them in check. The only practical way of keeping the alfalfa crop free from these intruding weeds is to cultivate it freely at certain periods in the season. Cultivation for this purpose is applied in the spring before growth has started, or just after the first cutting for hay has been removed and the field raked clean. These cultivations are additionally beneficial where the soil cracks badly. They fill these cracks and reduce loss of soil moisture from them. The disc harrow has frequently been used for these cultivations, but the spring-tooth harrow is now generally recognized as a better implement for this purpose. Spring-tooth harrows equipped with narrow teeth make it possible to cultivate thoroughly the alfalfa stand with very little damage to the alfalfa plants. Where the alfalfa has been seeded in drills the harrowing gives good results when done across the rows. This removes the grass in the rows more effectively and keeps the land more nearly level than when the harrowing is done in the direction of the rows. Cultivating alfalfa with a spring-tooth harrow is very

Spring-tooth harrow; an effective implement for cultivating established stands of alfalfa (After Stewart).

heavy work; three sections of the harrow require six good horses. The ordinary drag harrow may be used to good advantage after the spring-tooth harrow.

The Hay Crop.

When to cut.—In Alberta two cuttings of alfalfa hay are usually made each season except on irrigated land where a third cutting of fine quality is frequently secured. For certain northern localities a single cutting per season has been recommended; the second growth is left standing in order that it may hold snow during the winter and make more certain winter survival and moisture supply for the next season's crop. The practice of cutting once per season also obviates the difficulty that cutting in the fall stimulates fall growth which does not encourage the plants to go into dormancy to withstand winter conditions. In dry climates cutting is commonly done when the crop is estimated to be from one-tenth to one-half in bloom; while in moist climates cutting is usually done when the basal shoots are about one or two inches long. Alfalfa cut for hay at the tenth bloom stage or earlier has been found to be very nutritious and palatable, but somewhat low in yield, while if it was cut at the full bloom stage or later the yield has been higher but the nutritive and palatable qualities have been sacrificed to some extent. Moreover, the early cuttings have been followed by more winter killing and reduction in stand and yield in the following season, while late cuttings have been followed by maintenance of stand, earlier and more vigorous spring growth and better yield in subsequent years.

It would appear that ordinarily in Alberta, alfalfa should be cut for hay from about the half-bloom to the full bloom stages as a general practice. Cutting at this stage would seem to strike a reasonable balance between nutritive and palatable qualities on the one hand and yield and maintenance of a vigorous stand on the other.

Curing.—In the moister parts of the province difficulty is sometimes experienced in curing the first cutting on account of frequent rains, and consequently curing is a matter of considerable concern to many alfalfa growers. Alfalfa hay to be of highest quality must retain a large proportion of the leaves, which are the most nutritious parts of the plant; it must be bright green in color, have a pleasant smell and be dry enough to be stored without danger of deterioration through heating. To produce cured hay of this quality it is

necessary to rake the cut crop into windrows as soon as it has wilted. In hot dry weather this may be only two or three hours after cutting. Extended rapid drying makes the leaves very brittle and they drop off readily in subsequent handling, hence the early raking to retard drying. The hay should remain in the windrow until free moisture cannot be wrung out by twisting a wisp in the hands. Where drying is very rapid, or where the weather is uncertain, it is best to put the hay into cocks and leave until it is dry enough to be stored. Cocking also helps to preserve the color, as sunlight, together with dews and rains, cause bleaching and loss of the pleasant smell of good hay. Following wet weather, the cocks may have to be turned out on a bright day to dry sufficiently for storage.

Under irrigation where large acreages are grown stacking is usually done by means of stackers direct from the windrow.

Storage.—Barns or sheds are best for storing alfalfa hay, if spoilage is to be reduced to a minimum. Alfalfa hay stored outside in stacks always deteriorates through discoloration on the surface due to exposure to sunlight and storms. It also spoils next the ground unless a layer of straw or other material is placed on the ground when the stack is being built. If the stacks are not well made there may be loss through retention of water from storms in parts of the stack which do not quickly shed water. When stacking must be practised it is important to keep the centers high and the outside edges relatively low during the building process, so that after settling, the stacks will readily shed water.

The Alfalfa Pasture Crop.

The highly nutritive and palatable qualities of alfalfa make it a very valuable pasture crop for all classes of live stock. The crop, however, should not be pastured the season of seeding, as the trampling is liable to do serious damage to the stand, and the constant removal of the tops also prevents the plants establishing strong root systems. Nor should it be pastured too closely in subsequent years.

There is considerable liability to bloating with cattle and sheep when pasturing on vigorously growing alfalfa, and losses of animals from this cause sometimes occur. This is a risk that should always be remembered both because of possible financial loss and because of humane considerations. The risk varies with the individual animals, the climate and the condition of the crop, and cattle and sheep should always

be carefully watched when on alfalfa pasture. They should be turned into alfalfa pasture only when it is not damp with dew or rain, and then only after a preliminary feeding of other feed to which they have been accustomed. They should be left for only a short time at first. This should be repeated for several days until the animals have become accustomed to the alfalfa. Plenty of drinking water should be always available, and any animals that show symptoms of bloating should be permanently taken off alfalfa pasture.

Horses, hogs and poultry do well on alfalfa pasture. Horses should, however, go on alfalfa pasture from dry feed gradually, and ordinarily green alfalfa is too laxative to form a major part of the ration for horses doing heavy work or much travelling.

Hogs, particularly young hogs, thrive on growing alfalfa. In experiments at the University of Alberta, alfalfa has consistently shown its superiority over other hog pastures from the standpoint of promoting rapid and economical gains. The high proportions of protein and of calcium in growing alfalfa are particular characteristics on account of which this crop ranks so highly for hog-pasture purposes.

The Alfalfa Seed Crop.

Seed-growing districts.—While alfalfa is produced in many parts of Canada, there are two regions that produce the great bulk of the seed which goes into the seed trade. These are the Brooks district in southern Alberta and Peel County in Ontario, near Toronto. In the former district the Grimm variety of seed is grown, a large portion of each year's crop being registered; in the latter region the Ontario Variegated variety is grown extensively. Both these varieties are hardy and are about equal in hay-yielding capability.

The fact that, in general, the great bulk of alfalfa seed produced in North America is grown in a few restricted areas indicates that rather specific climatic conditions are necessary for seed production on a large scale. All these seed-producing areas, except that in Ontario, are characterized by arid or semi-arid conditions. In many, however, the seed crop is grown under irrigation. The moisture conditions are critical. Too much moisture at blooming time is detrimental, as it promotes excessive growth of stems and leaves, which inhibits flowering. Ideally there should be just enough moisture in the ground at this time to keep the plant from wilting or to keep it growing slowly. If the soil moisture is low, and if the

atmospheric conditions are such as to cause very rapid drying, the flowers are liable to wither and drop off before setting seed. Evidently rather restricted areas provide suitable moisture conditions for profitable seed production. Where the seed crop is produced under irrigation it is necessary to apply water very carefully so as to insure just the proper amount in the soil at flowering time. Seasons differ, and it appears difficult to lay down general rules regarding the time and amount of irrigation. Experience in irrigation and knowledge of the water requirements of the seedling alfalfa plant appear at present to be the only practical guides.

The weed problem.—While certain weeds, for example, wild oats, Canada thistle, etc., are quite readily controlled in the alfalfa hay field, these and others such as blue grass, wild barley, Russian thistle, dock, dodder, etc., are not so easily kept in subjection in the alfalfa seed field. The seed crop in Alberta requires the whole season to grow and mature. This gives opportunity for weeds to flourish and mature their seeds also in the crop. On this account, special efforts should be made to clean the land thoroughly before seeding alfalfa that is intended for seed production. This should be done particularly for those weeds the seeds of which are similar in size and weight to alfalfa seeds, and therefore very difficult to clean out of the threshed seed. After broadcast or close-row-drilled stands have become established the spring-tooth harrow should be used in the spring before any appreciable growth of the alfalfa has taken place. This treatment removes grasses and other weeds which have established themselves during the previous season. If serious weeds are prevalent in the stand in July, it may be advisable to cut the crop for hay rather than allow it to mature for a seed crop.

In very dry districts the alfalfa seed crop is planted in widely spaced rows (30 to 48 inches). This system facilitates inter-row cultivation by the same implements as are used for the ordinary inter-tilled crops, for example, corn or potatoes.

Seed-setting.—Alfalfa seed crops are very uncertain in the yield of seed. Seasons differ greatly in this respect. In some seasons for a given locality the yield may be good, in some the seed crop is a failure, while in others only a partial crop is obtained. The reasons for light yields are not always evident. In fact, the alfalfa seed-setting problem is one needing much careful study.

A few factors influencing seed-setting have been studied, and a few apparently valuable observations have been made. For instance, the wide spacing mentioned in a previous para-

graph appears to be an advantage. The thinner stand allows a free circulation of air and exposure to sunshine of all parts of the plant. These conditions are believed to be conducive to liberal seed-setting. Hence for seed-growing purposes alfalfa is preferably seeded more thinly than for hay purposes. The relation of soil and atmospheric moisture at blooming time, as referred to above, is apparently important in regard to the retention of the flowers until the seed pods have been formed.

Seed-setting is also dependent on the pollination of the flowers. Each flower must be pollinated, and it appears to be necessary in most cases that each flower be "tripped" in order for pollination to take place. The alfalfa flower having certain of its parts "locked," so to speak, has to be "tripped" by some external force in order that pollination of the flower may be effected. Some species of bumble bees and leaf-cutting insects visit the flowers for nectar and incidentally act as "tripping" agents. The more abundant these insects at flowering time the more likely is a large number of the flowers to be pollinated, and hence the more seed set. Certain weather conditions, namely, the interaction of varying temperature and moisture fluctuations, appear to cause alternate contraction and expansion of the floral parts, which results in the automatic "tripping" of the "locked" flowers. The most favorable weather conditions during flowering are alternate spells of cloudy and sunshiny weather with moderate wind and occasional showers.

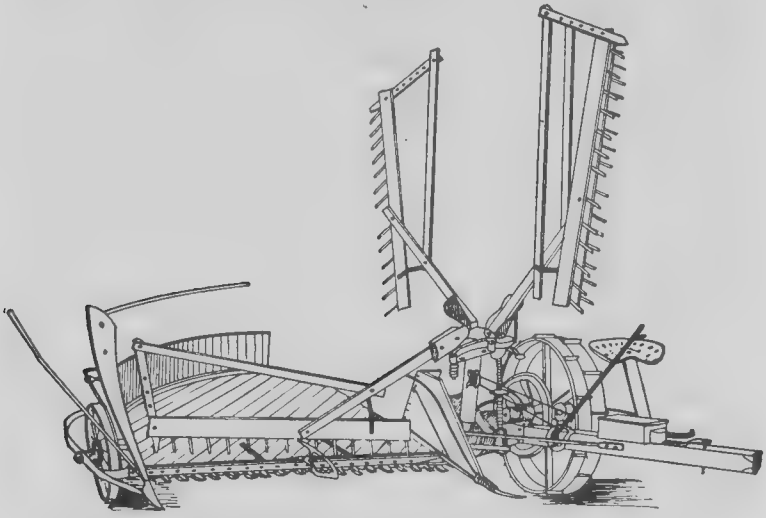
Individual alfalfa plants vary greatly in their seed productivity in a given set of conditions. The causes of this variation are evidently inherent, and the plant breeder is utilizing this condition to isolate and develop improved seed-yielding strains from high seed-producing individuals.

Harvesting the seed crop.—In Alberta the seed crop is usually cut in August or in early September. Alfalfa ripens its pods over a long period of time, and cutting cannot be delayed until all the pods are ripe, since the delay would endanger the crop to damage by early fall frosts. Consequently it is necessary to cut before all the pods are ripe. It is the practice in Alberta to cut when about half to two-thirds of the pods have turned brown or black.

The most practical implement to use for cutting in Alberta is the grain binder, the sheaves being bound rather loosely with twine. In the drier parts of the province the sheaves may be left as dropped by the sheaf carrier until dry enough for threshing, but in moister parts the sheaves should be set up in narrow shocks to dry out. It is desirable to handle the

sheaves as little as possible, in order to minimize loss through shattering.

The self-rake reaper is perhaps the best machine for cutting the alfalfa seed crop, but this machine is very rarely available. Some seed growers use the binder with a buncher while others use the mower with a bunching attachment. The combined harvester is also reported to have been used with excellent results in southern Alberta.



Self-rake reaper; a good machine for harvesting the alfalfa seed crop.

Threshing.—In some alfalfa seed-growing districts the clover huller is used for threshing; in others the ordinary grain thresher is used. Some large seed growers in Idaho and Montana are reported to have been using the grain thresher by preference. If the crop is thoroughly dry, if the thresher is equipped with suitable sieves, and if it is operated by a competent man, the thresher is fairly satisfactory. If, however, the crop is not quite thoroughly dried out and if special sieves are not available, the crop may be threshed with a grain thresher in which the concaves are screwed up close to the cylinder. The threshed seed comes out through the weed seed exit, while the unthreshed pods are collected from the grain spout. The latter are rethreshed or they may be put through any ordinary grain grinder in which the plates are adjusted so as to remove the pods from the seed, but not so close as to crush or injure the seeds. The latter operation

must be very carefully done or the seed may be considerably damaged.

Cleaning.—Any one of the commonly used fanning mills, if equipped with suitable sieves, is ordinarily satisfactory for cleaning alfalfa seed, except for lots which contain weed seeds of similar size, shape and weight to those of the alfalfa seeds. Russian thistle and sweet clover seeds, for instance, are very difficult to remove by means of the sieves and the wind blast of any seed-cleaning machine. For the fanning mill two sieves are used, one above which removes materials larger, and one below which removes materials smaller than the alfalfa seeds. The size of mesh of each sieve varies somewhat with the plumpness of the alfalfa seed. Zinc sieves with round perforations 1/14, 1/15 or 1/16 inch in diameter, according to the size of the seed, may be used above, while woven wire screens 4x22, 4x24 or 4x26 wires to the inch may be used below in the fanning mill. These sieves and screens must be kept clean if they are to do good work. If the proper sieves cannot be secured from the manufacturer of the available fanning mill, the sieve material of these sizes of mesh may be obtained from Messrs. A. T. Ferrell & Co., Saginaw, Michigan, U.S.A., and the sieves made up by hand to fit the fanning mill.

Grading the seed.—If alfalfa seed is to be sold for seeding purposes in Canada it must first be graded by the Seed Branch, Dominion Department of Agriculture, and sold under grade number. All Alberta seed is graded at the Seed Branch offices and laboratory at Calgary. There are three commercial grades for alfalfa seed, namely, No. 1, No. 2 and No. 3. The grade of a particular lot of seed is determined from a representative sample (3 or 4 ounces), by the number of weed seeds, the number of seeds of other crop plants, the content of inert matter and the percentage of germinable alfalfa seeds the sample contains.

Summary.

1. Alfalfa is probably the oldest and best forage crop used by man. It is high in yield, richly nutritious, relatively cheap to produce, and it improves worn-out and heavy soils.

2. The Grimm variety of alfalfa is recommended for Alberta conditions.

3. Well-drained land free from depressions and containing some lime is best for alfalfa. Well-prepared summerfallow or a clean hoed-crop provides the most suitable preparation.

Except on irrigated land the use of stubble land for alfalfa is inadvisable.

4. Use Registered Grimm or No. 1 alfalfa seed if at all possible. It is unwise to use inferior or questionable seed for a long-lived and valuable crop like alfalfa. Ascertain if possible the kinds and proportions of noxious weeds contained in alfalfa seed under consideration for purchase.

5. Inoculation of seed is recommended where alfalfa is to be grown on land which has not in recent years grown alfalfa or sweet clover. Three methods of inoculation are described.

6. For practically all agricultural parts of Alberta except on irrigated land it is strongly recommended that alfalfa be sown without a nurse crop which is intended for grain or green feed.

7. On dry land either the press drill or the ordinary grain drill is satisfactory for seeding alfalfa if the seed is first mixed with about twice its bulk of cracked wheat. On irrigated land the seed may be sown broadcast and harrowed in. Whatever method of sowing is used the seed should not be seeded more than an inch or an inch and a half deep.

8. If a nurse crop is not used alfalfa may be seeded in most parts of Alberta from May 15th to July 1st. The best time is probably from June 1st to June 15th. Seeding with a nurse crop should be earlier.

9. From ten to twelve pounds of good seed per acre is the usual amount to sow on dry land, but fifteen to twenty pounds are sometimes sown on irrigated land. If seeded in 36-inch rows two to four pounds of seed are ample.

10. During the season of seeding alfalfa must be handled carefully. The weeds must be kept in check by mowing, and no pasturing should be allowed.

11. Deterioration of established stands of alfalfa may be minimized by the use of the spring-tooth harrow in early spring and directly after the removal of the first cutting of hay.

12. In Alberta it appears that alfalfa should be cut for hay from about the half-bloom to the full-bloom stages as a general practice.

13. Alfalfa hay greatly depreciates in value if it is not properly cured. Care must be exercised to preserve the leaves, the good color and the pleasant smell.

14. Barns or sheds are best for storing alfalfa hay. If stacks are used, losses may be reduced by proper methods of stacking.

15. Alfalfa provides excellent pasture for all classes of live stock. Great caution must, however, be exercised with cattle and sheep to guard against losses from bloating.

16. Most of the alfalfa seed produced in Canada is grown in restricted areas having specific climatic conditions. The amount of seed set in a given season is dependent largely on the weather conditions during certain critical stages in the growth of the crop and on the prevalence of "tripping" agencies which assist in pollinating the flowers.

17. While alfalfa as a hay crop suppresses many kinds of weeds, as a seed crop it is not nearly so effective in weed control.

18. The seed crop is cut in Alberta when about half to two-thirds of the pods have turned brown or black. The grain binder set to bind loosely and the self-rake reaper are suitable machines for harvesting the seed crop.

19. The clover huller is used for threshing alfalfa seed. In many districts the ordinary grain thresher is used. The latter is quite satisfactory if equipped with suitable sieves and if it is operated by a competent man.

20. The threshed seed may be cleaned in most cases by the ordinary fanning mill if it is equipped with sieves of suitable mesh. After cleaning the seed must be graded by the Dominion Seed Branch before it may legally be offered for sale for seeding in Canada.